

Examining Mindfulness Meditation Focused-Attention  
with the MBAS and Solving Anagrams

A Senior Thesis

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By

Katharine N. Black

The Ohio State University, Lima

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Project Advisor: Joseph P. Green, Ph.D., Department of Psychology

## Abstract

As part of a programmatic line of research, we examined whether a brief mindfulness meditation training with the *Meditation Breath Attention Scores* (MBAS; Frewen, Evans, Maraj, Dozois, & Partridge, 2008; Frewen, Lundberg, MacKinley, & Wrath, 2011) enhanced anagram-solving performance. Current results replicated earlier findings of improved anagram performance following the MBAS. Participants solved two sets of 15 anagrams separated by the MBAS. We randomized students into either an MBAS-expectancy or MBAS-no expectancy condition. In order to examine the effects of our expectancy manipulation on anagram solving performance, those in our MBAS-expectancy group were told that they would be able to solve anagrams “*more quickly and accurately*” on trial 2. Unexpectedly, students in our expectancy condition did not provide higher estimates for the number of anagrams they would solve on trial 2. Participants solved more anagrams on trial 2 across both conditions relative to trial 1. Our results provide additional support for the MBAS as a brief mindfulness training method to improve performance on solving anagrams.

## *Introduction*

Empirical evidence suggests that the use of meditative practices may promote regulation of attention and affect (Lutz, Slagter, Dunne, & Davidson, 2008). There are many traditions of meditation. Some involve an open, nonjudgmental, present moment focused-awareness. Another style is concentrative meditation where the meditator focuses on an object, mantra, or sensory experience such as focusing on the breath to enhance attention. Semple (2010) argued that mindfulness is a generally accepted means of enhancing attention. Sedlmeier and colleagues (2012) reviewed the literature on beneficial effects of meditation and reported medium effect sizes for changes in attention, emotionality, and relationship problems. Mindfulness meditation exercises can be instrumental in relieving stress, anxiety, and emotional distress. For example, Hoffman and colleagues (2010) probed 39 studies that examined mindfulness-based stress reduction or mindfulness-based cognitive therapy. They found a moderate effect for improvement in mood symptoms and anxiety among those afflicted with symptoms of depression, general anxiety disorder, and cancer, as well as other medical and psychiatric issues.

Various researchers and writers define mindfulness meditation differently. Kabat-Zinn (2015) described mindfulness as “paying attention in a specific way” while tending to the present moment with a non-reactive and non-judgmental awareness. Langer and Moldoveanu (2000) proposed that mindfulness includes attending to novel material with a fresh and flexible perspective that may lead to heightened awareness in problem solving. Cahn and Polich (2006) stressed that meditation practice leads to changes in attention. Considering the diversity of meditation practices, Malaktaris, Lemons, Lynn, and Condon (2015) concluded that, “meditation represents a broad category of self-regulation practices that focus attention and awareness” (p. 144). Importantly, with training and practice, attentional skills may improve. It appears that

meditation may be helpful, perhaps even for inexperienced meditators (Jha, Krimping, & Baime, 2007). Several researchers found that the beginning stages of meditation produce enhanced activity in both the cingulate gyrus and prefrontal cortex while others reported that meditation increased brain activity in areas relevant to cognitive and emotional processing (Halsband, et al., 2009).

Frewen and colleagues operationalized mindfulness as meditative concentration. They developed the MBAS as a performance-based measure of individual differences in focused attention. Frewen et al. (2011) describe the MBAS as a measure of participants' ability to sustain attention towards their breathing during a focused-breath mindfulness meditation. During the MBAS, participants close their eyes and focus on their breathing. Periodically a chime sounds and participants indicate whether they are, at that very moment, exclusively focused on their breath or distracted by extraneous thoughts or emotions. Frewen originally designed the MBAS as an assessment measure; however, it serves as a meditation intervention as well, particularly when practiced repeatedly (personal communication, December 5, 2016). Frewen et al. (2010) reported that higher scores on the MBAS were associated with greater self-reports of the use of a mantra to focus attention during the MBAS, less distracting thoughts, and enhanced feelings of relaxation. Frewen and colleagues reported positive correlations between the MBAS and the "acting with awareness" subscale of the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Tolney, 2006),  $r = .38$  (Frewen et al., 2011) and  $r = .27$  (Frewen et al., 2014).

Solving anagrams is a reliable measure of problem solving. Mendelsohn, Griswold, and Anderson (1966) found that those with superior anagram solving abilities tended to be able to "shift attention in a directed but flexible manner." Powers (2014) utilized an anagram task to

study the effects of meditation training. In this study, the author trained subjects in focused attention and open-monitoring meditation over an 8-week period. The focused attention training was more helpful and led to thinking that was more productive during problem-solving tasks.

Positive response expectancies may enhance individual performance on subjective and objective measures (e.g., see, Kirsch, 1999). The MBAS may result in positive response expectancies. Accordingly, if our participants solved more anagrams following the MBAS then their success might be due to either meditational focus or positive response expectancies. In order to try to separate these questions, we told approximately half of our participants that they would solve puzzles more quickly and accurately on the second trial. We predicted that students receiving the expectancy enhancement would record higher estimates of the number of anagrams that they would correctly solve and lead to better performance during the second trial.

Multiple sessions of mindfulness training may be optimal to produce certain mental effects (see Lai, MacNeil, & Frewen, 2015). However, there is also evidence to support the view of positive benefits of meditation from brief training approaches. In a recent study, Creswell, Rahl, Lindsay, Pacilio, & Brown (2017) found that a brief 20-minute attention-monitoring and acceptance mindfulness program enhanced performance on a sustained attention to response task (SART), relative to both a relaxation and reading control condition. Their results support the benefit of brief mindfulness training as revealed by a reduction in mind wandering (e.g., distracting thoughts). Zeidan and colleagues (2010) reported significant improvement on several tasks requiring executive functioning and prolonged periods of attention after administering four 20-minute focused-breath meditation sessions (one session per day over a four-day period).

Our study builds on the fact that even brief training in meditation may be associated with

enhanced attentional focus. We wanted to examine whether the MBAS would enhance anagram-solving performance. In order to test this hypothesis, we administered two sets of anagrams separated by training on the MBAS. We hypothesized that the MBAS would enhance attentional focus and result in better performance on a second anagram trial relative to baseline scores.

In a previous study (Green & Black, in press), participants solved two sets of 15 anagrams separated by either training on the MBAS, a progressive muscle relaxation (to control for relaxation effects), or a psychology video (control) (Annenberg Learner, 2001). We announced to roughly half of our participants that they would be able to solve anagrams “*more quickly and accurately*” on trial 2 (i.e., expectancy enhancement) after their respective training. As predicted, we found a significant main effect for condition. Specifically, we found that participants who completed the MBAS solved more anagrams at trial 2 compared to those in the video condition. Students’ actual anagram solving performance did not improve after receiving the expectancy manipulation; however, they did report higher estimates for the number of anagrams they guessed they would be able to solve on trial 2. Our current study attempted to replicate our previous finding that the MBAS enhances attentional focus and leads to improved anagram solving ability.

## Methods

### *Participants*

A total of 199 undergraduate students enrolled in introductory psychology classes at the Ohio State University, Lima participated in the current study. Final data analyses were based on a total of  $N=140$  ( $n=72$  male and  $68$  female;  $M_{age} = 19.06$ ,  $SD = 2.04$ ). A total of 59 participants were eliminated; 18 reported engaging in meditation on a regular basis (e.g., once a month or more); 1 case was removed based on extreme anagram difference scores (i.e., exceeding 1.5 the

interquartile range; these outliers scored less than or equal to -6 or worse; or more than or equal to +7), and others either provided a significant amount of incomplete data or failed to follow instructions (e.g., skipped a page in the response booklet, were notably distracted or not fully engaged).

### *Materials*

*Anagrams.* We composed two sets of 15 anagram puzzles. We selected words ranked as being equally difficult on both lists (i.e., the sum of bigram difficulty rankings was 533 for each list; Gilhooly, 1978; Mendelsohn & O'Brien, 1974). Our word lists were also comparable in terms of ratings of familiarity, concreteness, and imagery (Olson & Schwartz, 1967; Gilhooly & Hays, 1977). In a previous study using these anagram lists, we found that students scored nearly identically across the two trials (Black & Green, 2014). Accordingly, we administered the anagram lists in a fixed order. Each of our word puzzles were one-syllable, five-letter words. Each puzzle required three steps to solve.

*Meditation Breath Attention Scores and MBAS focus scores* (MBAS; Frewen et al., 2008; 2011). Participants received instructions about what to expect on the MBAS. Including 4 minutes and 40 seconds for instructions, the entire session lasted 19 minutes and 40 seconds. The session began with a short practice exercise where students mindfully focused on their breath and attended to their breathing while trying to keep distracting thoughts at bay. We told participants that if their thoughts wandered, they should gently refocus their attention on their breathing as best they can. Students then began the focused breathing meditation. At five time points (spaced every 2 minutes during the meditation exercise), a chime sounded. At this point, students opened their eyes and indicated in the response booklet whether they were focused on their breathing or if they were distracted by extraneous thoughts or emotions at the exact moment

that the chime sounded. Focus scores on the MBAS can range from 0 to 5 with higher scores reflecting greater concentration on breathing and less distractedness. Frewen et al. (2014) reported that MBAS scores increased with practice. Across several studies, the authors reported a test-retest correlation of  $r=.50$  over several different testing sessions.

*Expectancy Manipulation.* We told approximately half of our participants that the intervention they just received would lead to improved performance on anagram trial 2. In particular, we told participants that they should be able to solve the second set of anagrams “*more quickly and accurately*” because of their training on the MBAS mindfulness meditation exercise. The other participants did not receive an expectancy manipulation before beginning the second anagram trial.

*Pre-anagram trial questions.* Before each anagram trial began, students estimated how many of the 15 anagrams they thought they would solve. Before the second anagram trial, we also asked, “How much do you think the meditation exercise will help you to solve anagrams on the next trial?” Responses were recorded on a 7-point Likert scale (1=*not at all*; 4=*somewhat*; 7=*very much*).

*Post-anagram trial questions.* Following each anagram trial, we administered the following questions: 1. *How relaxed did you feel during the puzzle task?* 2. *How much were you able to concentrate during the puzzle task?* 3. *How well were you able to keep distracting thoughts out of your mind during the puzzle task?* 4. *Compared to an “average” student completing the exact same puzzle task, how well do you think you performed?* After the second anagram trial, we included the following question as well: 5. *How much did the meditation exercise help you to concentrate and solve puzzles on this last trial?* The response format for all post-anagram-trial-questions was the same (1=*not at all*; 4=*somewhat*; 7=*very much*).



*Positive and Negative Affect Scale (PANAS; Watson, Clark & Tellegen, 1988).* The PANAS consists of 10 positive (PA; e.g. enthusiastic, alert) and 10 negative (NA; e.g., distress, anger) mood adjectives. Participants rated how they currently felt (i.e., “right now”) using the following scale: (1=*very slightly or not at all*; 3=*moderately*; 5=*extremely*). Watson and colleagues (1988) found that the PANAS was sensitive to shifts in mood when administered with instructions to provide “short-term” responses (e.g. present moment state). The scales have good inter-item consistency and test-retest reliability (see Watson et al., 1988; Carroll et al., 2009).

*Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006).* The FFMQ is a 39-item self-report survey measuring mindfulness traits. The scale utilizes the following response format (1= *never or very rarely true*; 3= *sometimes true*; 5= *very often or always true*). There are five facets on the FFMQ including, *Observing* (8-items), *Acting with Awareness* (8-items), *Describing* (8-items), *Non-judging of Inner Experience* (8-items), and *Non-reactivity to Inner Experience* (7-items). The *Observing* facet measures attention to internal and external experiences (e.g., “*I notice the smells and aromas of things*”). The *Acting with Awareness* scale assesses the ability to focus and attend to daily activities and not allow your mind to wander (e.g., “*I find it difficult to stay focused on what’s happening in the present*” - reverse scored). The *Describing* facet measures one’s ability to accurately describe or label subjective experiences (e.g., “*I’m good at finding words to describe my feelings*”). The *Non-judging of Inner Experience* scale measures the ability to think and feel without judging thoughts or emotions or labeling them as being good or bad (e.g., “*I make judgments about whether my thoughts are good or bad*” - reverse scored). The *Non-reactivity to Internal Experience* reflects a willingness to allow feelings and thoughts to come and go without obsessing about them (e.g., “*In difficult situations, I can pause without immediately reacting*”). The items comprising the

FFMQ facets have adequate internal stability (Baer et al., 2008).

### Procedure

We followed the MBAS administration procedure used in an earlier publication (see Green & Black, in press). We ran study sessions in existing introductory psychology classes at our university. We recruited samples from six classes over a period of two academic semesters. We randomized participants into two different conditions. Half of our participants received an expectancy manipulation and the others did not.

*Anagram Trials.* We presented our anagrams one at a time on a classroom screen. All of our word puzzles appeared as black letters on a white background. All of the anagrams appeared for two seconds, were masked for two seconds, and then reappeared for six seconds. Pilot testing showed that this presentation strategy reduced ceiling and floor effects; meaning that, students rarely answered all of our anagrams and most solved at least several. We arranged anagrams sequentially and presented them via a computerized movie clip. A narrated voice instructed participants on how to record their answer, when to “stop writing,” their solutions, and when to turn the page within their booklets and “get ready” for the next trial. We provided students with a separate response page for each anagram that included five lines (a line for each letter) to record their answers. Students were instructed to leave the response page blank if they could not solve the word puzzle. We provided a sample anagram to participants before beginning each of our two test trials. Then, the audio explained that they would receive 15 more anagrams and that each puzzle had only one solution.

*Anagram Estimates and PANAS.* We asked participants to estimate how many anagrams they thought they would be able to solve before each of the two anagrams trials and how much they thought the intervention would help them to solve anagrams on trial 2. All participants

completed the PANAS before anagram trials 1 and 2.

*Experimental Intervention (MBAS).* All of our participants received the MBAS intervention before solving trial 2. We randomized participants into two conditions (MBAS-expectancy vs. MBAS-no expectancy) and separated them into two classrooms that provided a nearly equivalent testing environment.

We administered the MBAS via an audio file. The MBAS recording began by providing guided instructions on how to participate in the meditation exercise. The audio instructed participants to close their eyes and focus on their breathing. Students were then given a practice opportunity to count several breaths in order for them to “observe your breath travel down into your lungs, observe the moment when the inhalation ends and the exhalation begins, and observe your breath now travel up again and out your nose.” The audio then instructed students to continue focusing on their breaths for another seven counts. We assured students that it was “okay” if they were distracted from focusing on their breath “by thoughts, memories, or emotions”; and if distracting thoughts occurred, they should “gently refocus their attention on their breathing.” After students finished the practice portion of the exercise, they sat quietly during the remainder of the meditation while continuing to focus their attention and awareness on their breathing without counting their breaths.

During the instructional portion of the MBAS meditation exercise, students received directions on how to complete the response sheet to indicate whether they were focused on their breathing or distracted at the exact moment the bell chimes. The response sheet consisted of five separate boxes labeled with the relevant sequenced bell-time (i.e., Bell #1 through Bell #5) and students chose one of two response options (“Focused on breathing” or “Distracted”). They were informed that they would periodically hear a bell chime during the meditation (the sound

was played as a demonstration). The audio explicitly stated during the instructions, “If – just before the moment that the bell sounded – you were distracted away from your breathing and were focusing on thoughts, memories, emotions, or other things, you would circle distracted for that trial. If, when the bell rings, you were focused only on your breathing, as you are trying your best to do, you would circle “focused.” The bell chimed five times during the meditation exercise. After responding to the last bell, the meditation ended.

*Expectancy Manipulation.* Participants in our expectancy condition were informed that the MBAS intervention would lead to improved performance on anagram trial 2. We told participants that they should be able to solve the second set of anagrams “*more quickly and accurately*” because of their training on the MBAS. The other participants did not receive any expectancy manipulation before beginning the second anagram trial.

*Anagram Trial 2.* Immediately before completing the second trial, participants were asked to indicate how much they thought the MBAS focused-breath exercise would help them to solve anagrams on trial 2. Just as they did before solving trial 1, participants again estimated how many anagrams they thought they would solve on the second trial.

*Post-Anagram Trial Questions, FFMQ, and PANAS.* After the second anagram trial, students completed the second set of post-anagram trial questions, the FFMQ and, once more, the PANAS. We administered the Positive and Negative Affect Scale (PANAS) at three time points during the study (i.e., before trial 1, before trial 2, and at the end of the study). This allowed us to compare affect levels between our groups across different time points. Participants also completed the Five Facet Mindfulness Questionnaire (FFMQ) and some post intervention questions, allowing us to examine links between individual mindfulness traits and MBAS performance.

## Results

### *Preliminary Analyses*

*Age and gender distribution.* We administered the expectancy instructions to a total of 64 participants ( $n=27$  female;  $n$  male=37), while another 76 participants ( $n$  female=41;  $n$  male = 35) did not receive the expectancy instructions. Results of a one-way analysis of variance (ANOVA) showed that the age of participants was similar across the two expectancy conditions,  $F(1,138)=0.07, p=.80$ . The results of a Chi-square test revealed that the proportion of males to females was roughly equivalent across conditions as well,  $\chi^2(1; N=140)=1.92, p=.18$ .

*Trial 1 variables.* In order to check that our quasi-randomization of participants to the different expectancy conditions resulted in our two groups being relatively matched on our pre-intervention variables, we conducted a 2 (Condition) x 2 (Gender) multivariate analysis of variance (MANOVA) on the following measures: affect balance scores (from administration time 1 before the MBAS), the number of anagrams estimated to be solved as well as actual number of trial 1 anagram scores, and the 4 post-trial 1 questions. Univariate tests on double interactions and main effects of condition were all non-significant, all  $F_s(1,136)<2.35$ , all  $p_s>.13$ . The main effect tests on gender were also non-significant [all  $F_s(1,136)<2.07$ , all  $p_s>.15$ ] with the exception of two indices. Male participants ( $M=9.29, SD= 2.58$ ) estimated that they would solve more anagrams than females ( $M=8.50, SD= 2.03$ ),  $F(1,136)<3.80, p>.05$ . Male students ( $M=3.51, SD= 1.56$ ) also tended to report being relatively more relaxed during the first anagram trial relative to females ( $M=3.09, SD= 1.41$ ),  $F_s(1,136)<3.52, p>.06$ .

### *Primary Analyses*

*The effect of the expectancy manipulation on ratings of: a) the perceived helpfulness of the MBAS; b) the number of anagrams students estimated that they would solve; and, c) affect*

*balance scores from the PANAS completed just before the meditation exercise.* We conducted a 2 (Condition) x 2 (Gender) MANCOVA on these ratings using the number of anagrams solved on trial 1 as a covariate. There was no multivariate effect for the double interaction,  $F(3,133)=0.76$ ,  $p=0.52$ . Somewhat surprisingly, there was no multivariate effect for our expectancy instructions [ $F(3,133)=.14$ ,  $p=0.94$ ], nor were there any significant univariate tests, all  $F_s(1,136)<0.34$ , all  $p_s>.56$ . There was a significant multivariate effect for gender,  $F(3,134)=5.89$ ,  $p=.001$ .

Univariate tests indicated that female students (adj.  $M=3.32$ ,  $SE=0.17$ ) perceived the MBAS to be more helpful to their ability to solve future anagrams than did male students (adj.  $M=2.72$ ,  $SE=0.16$ ),  $F(1,135)=6.78$ ,  $p=.01$ . There were no gender differences across either students' estimate of the number of anagrams they predicted that they would solve or on affect balance scores following the MBAS,  $F_s(1,135)<2.28$ ,  $p_s>.13$ .

#### *Anagram Performance*

We conducted a 2 (Condition) x 2 (Gender) repeated measures ANOVA on the number of anagrams solved across the two trials. The triple interaction including trial time was not significant  $F(1,136)=0.25$ ,  $p=.62$ . Both double interactions involving trial time were not significant as well,  $F_s(1,136)<1.38$ ,  $p_s<0.24$ . We found a main effect for trial time,  $F(1,136)=6.61$ ,  $p=.01$  (see table 1). Following the MBAS, participants solved more anagrams, on average, on trial 2 ( $M=9.09$ ,  $SD=3.87$ ) relative to trial 1 ( $M=8.59$ ,  $SD=3.43$ ). Cohen's  $d=.14$  indicating a small effect size.

*Post-Trial 2 Questions and the final administration of the PANAS.* We conducted a 2 (Condition) x 2 (Gender) MANOVA on the five post-trial questions following trial 2 and on affect balance scores originating from the PANAS completed at the end of the study. The multivariate effects for the interaction and for the expectancy intervention were not significant,

$F(6,131) < 0.80$ ,  $ps > .57$ . We obtained a significant multivariate effect for gender,  $F(6,131) = 2.46$ ,  $p = .03$ . Univariate tests revealed that female students ( $M = 3.29$ ,  $SD = 0.23$ ), relative to male students ( $M = 2.68$ ,  $SD = 0.21$ ), rated the breathing exercise as more helpful to concentrate and solve puzzles on the second trial,  $F(1,136) = 3.93$ ,  $p = .05$ . In addition, male students ( $M = 4.24$ ,  $SD = 0.18$ ) tended to rate their ability to concentrate on the puzzle task higher than that of our female student participants ( $M = 3.78$ ,  $SD = 0.19$ ),  $F(1, 136) = 3.08$ ,  $p = .08$ . The other variables did not differ by gender, all  $F(1,136) < 1.63$ ,  $ps > .20$ .

*Affect Balance Scores across time.* We created *affect balance* scores by subtracting NA scores from PA scores. We conducted a 2 (Condition) x 2 (Gender) repeated measures ANOVA on PANAS composite scores. The triple interaction and both double interactions involving time were not significant,  $F(2,135) < 0.48$ ,  $ps > .62$ . We found a main effect for time,  $F(2,135) = 20.58$ ,  $p < .001$ . Affect balance scores declined across our three time points in a linear manner,  $F(1,136) = 37.84$ ,  $p < .001$ .

### *Correlational Analyses*

We calculated a number of correlations between our various measures. In order to easily display relative improvement in solving anagrams following the MBAS, we calculated anagram difference scores by subtracting the number of anagrams solved on trial 1 from those on trial 2. Larger difference scores indicate greater improvement in anagram solving across the trials. Anagram difference scores did not correlate with MBAS focus scores, or any of the five subscales of the FFMQ.

Affect balance scores positively correlated with MBAS focus scores at all three time points times indicating that participants who reported having more positive affect also reported being more focused during the MBAS. Affect balance scores also correlated positively with the

FFMQ subscale, *Acting with Awareness* at all three time points, suggesting that the more focused participants were during the MBAS, the more aware and focused they generally are during daily present moment experiences (see table 2).

### Discussion

As hypothesized, we replicated our finding from our earlier study (Green & Black, in press) and found that participants who received the MBAS training did indeed solve more anagrams on trial 2 relative to trial 1. However, the MBAS focus scores, reflecting the amount of concentration during the breathing exercise, did not correlate with the number of anagrams solved. In other words, although the MBAS exercise itself resulted in improved performance solving anagrams, the relative ability to keep one's focus on their breathing during the MBAS exercise (i.e., individual focus scores) did not seem to matter. We suggest that our findings validate the MBAS as an interventional strategy to improve problem solving with anagrams but we did not find evidence to support that the number of anagrams solved varied by individual performance on the MBAS. As such, the MBAS does not appear to be a reliable measure of individual differences regarding attentional focus.

Our expectancy manipulation did not have the intended effect of increasing the number of anagrams participants estimated that they would solve. This finding stands in contrast to what we found earlier. That is, in our first study on this topic (Green & Black, in press) we found that the expectancy manipulation did indeed lead to greater estimates of the number of anagrams subjects thought they would solve. However, this increase in estimation did not translate to actual improved performance in solving anagrams. Consistent across both studies was the fact that students completing one session of the MBAS solved approximately  $\frac{1}{2}$  more anagrams on the second trial compared to their first attempt. Although one could interpret the results from our



second study as possibly reflecting practice effects, our first study design makes this interpretation unlikely. In our first study, we employed three conditions: MBAS, progressive muscle relaxation, and a video (control) condition. Participants in the video condition actually performed worse on the second trial. Participants in the relaxation condition improved but only slightly. This differential pattern of performance suggested that something other than practice effects was likely the reason for enhanced anagram solving in the MBAS condition.

**Table 1** Anagram Trial Time Performance by Condition and Gender

	Trial 1 (pre-MBAS)	Trial 2 (post-MBAS)	<i>F</i>	<i>p</i>
Anagram Scores by Trial ( <i>N</i> =140)	<i>M</i> =8.59, <i>SD</i> =3.43	<i>M</i> =9.09, <i>SD</i> =3.87	6.61	0.01
MBAS-Expectancy ( <i>n</i> =64)	<i>M</i> =8.06, <i>SD</i> =3.59	<i>M</i> =8.81, <i>SD</i> =3.98		
MBAS-No Expectancy ( <i>n</i> =76)	<i>M</i> =9.03, <i>SD</i> =3.26	<i>M</i> =9.41, <i>SD</i> =3.65	1.02	0.31
Male ( <i>n</i> =72)	<i>M</i> =8.17, <i>SD</i> =3.68	<i>M</i> =8.54, <i>SD</i> =4.07		
Female ( <i>n</i> =68)	<i>M</i> =9.03, <i>SD</i> =3.12	<i>M</i> =9.68, <i>SD</i> =3.58	3.02	0.09

Consistent across both studies, we found a significant main effect for time of administration for PANAS composite scores showing a continuous decline in scores at each time point. Perhaps these scores reflect fatigue or frustration with the fact that students completed the same PANAS scale three times during the study. In the present study, we found small positive correlations between the PANAS affect balance scores across all three of our time points and the MBAS focus scores as well as the FFMQ *Acting with Awareness*, *Non-judging of Inner Experience*, and *Non-reactivity to Inner Experience* subscales. These positive correlations indicate that those participants who reported more positive affect also reported the ability to focus and attend to daily activities, the ability to think and feel without judging thoughts or emotions, and a willingness to allow feelings and thoughts to come and go without obsessing about them as measured by the FFMQ. In contrast to our measure of positive affect, Frewen reported a robust *negative* correlation between the frequency and difficulty of letting go of

depressive cognition and the FFMQ subscale *Acting with Awareness* (Frewen, Lundberg, MacKinley, & Wrath, 2011; study 2). Across both sets of correlations, it seems that participants who were more presently focused tended to experience relatively more positive emotions and could more easily let go of unpleasant thoughts and feelings. Relatedly, Logie and Frewen (2015) reported that a brief 15-minute mindfulness training session produced positive emotional responses and enhanced connection to others.

**Table 2** Correlations Across MBAS Focus Scores, FFMQ, and PANAS Affect Balance

	1	2	3	4	5	6	7	8	9
1 MBAS Breath Focus Score		.15	.03	.16	.03	.21*	.23**	.31**	.27**
FFMQ									
2 Observe			.35**	-.15	-.27**	.43**	.04	.05	.03
3 Describe				.27**	.04	.31**	.06	.15	.13
4 Awareness					.33**	.05	.26**	.35**	.30**
5 Non-Judge						-.23**	.27**	.17*	.22*
6 Non-React							.19*	.23**	.29**
PANAS Affect Balance (PA-NA)									
7 Time 1								.83**	.73**
8 Time 2									.86**
9 Time 3									

\*\*Correlation is significant at the 0.01 level (2-tailed); \*Correlation is significant at the 0.05 level (2-tailed)  $N=140$

We found that when asked how much they felt that the MBAS would help them to solve anagrams on trial 2, female students perceived the MBAS to be more helpful to their ability to solve future anagrams than did male students. Following trial 2, female students also rated the breathing exercise as more helpful to concentrate and solve puzzles on the second trial relative to male students. Shao and Skarlicki (2009) argued that the association between mindfulness and individual performance might be a function of gender. They conducted a multiple regression analyses in order to explore whether mindfulness as measured by the *Mindful Attention Awareness Scale* (Brown & Ryan, 2003) and gender would predict Graduate Management

Admission Test (GMAT) performance. They found a positive relationship between mindfulness and female's academic performance on the GMAT that was not found with male subjects.

Females in our current study did in fact solve more anagrams than males after receiving the MBAS but failed to reach significance. In addition, our female students perceived that the MBAS would be more helpful to their ability to solve future anagrams (before trial 2) and reported the meditation breathing exercise as more helpful to solve anagrams on the second trial than our male students; both reaching significance.

#### *Study Limitations and Future Direction*

Our study is limited in that it was quasi-experimental in design. Specifically, we recruited and randomized participants into our two conditions from existing undergraduate introduction psychology classes. In addition, due to limited resources and personnel, we were limited to administering only a brief, single-session mindfulness meditation exercise.

Our primary result of improved anagram solving performance after a single training session on the MBAS is consistent with our previous finding (Green & Black, in press). Future studies should explore whether larger effects on problem solving tasks requiring concentration and focused-attention might be found among participants more extensively trained in mindfulness meditation. It would be interesting to test students' ability to concentrate and problem solve, for example, after multiple training sessions with the MBAS. In addition, the results of this study open up the possibility of future research exploring and teasing apart elements associated with mindfulness traits, meditation focused attention, affect balance, and gender differences relative to both attentional and emotional regulation, and problem solving ability.

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